

miert und dabei die einzelnen in ihrer Sondernatur vernichtet (Summationsorgan)" (p. 292). Final causes are postulated. "Ohne Berücksichtigung von Finalia ist ein Verständnis auch der einfachsten Amöbenhandlung unmöglich." His account of instinct, therefore, is through and through teleological. The ends pursued are not to be explained from experience, on one hand, nor are they explicable in terms of organisation as a product of evolution. They can only be accounted for in terms of an "Allgemeinbewusstsein," or "Weltvernunft," an absolute consciousness. Kant and Hartmann are referred to more than once, nor is Hegel omitted. Those men of science to whom metaphysics is anathema, and those (a class comprising much the same people) to whom it is a *terra incognita*, will reject much of the book as unsound. For others the book will be found full of suggestions and new points of view.

WILLIAM BROWN.

SCALE MOSSES.

The Liverworts, British and Foreign. By the Right Hon. Sir Edward Fry, G.C.B., with the assistance of Agnes Fry. Pp. viii+74. (London: Witherby and Co., 1911.) Price 2s. 6d. net.

IT is a pleasure to welcome the little volume on liverworts, to which scale mosses, as well as the more familiar Thalloid forms, like *Marchantia*, belong. Sir Edward Fry has long been known as one who takes a keen interest in mosses, and this new little book on an allied group of plants will appeal to those amateurs who like to know something at first hand of the less easily studied objects of nature. In truth, the liverworts are fascinating plants, for they stand at the parting of the ways where the higher forms branch off from the lower series of primitive groups. They are, however, not easy to study, for they need a keen eye to detect them, and they are, many of them, very difficult to identify.

The authors have done good service in giving a popular and attractive account of the family. The variety of forms, no less than the suggestive differences in their organisation, pointing as it does towards higher vegetative development, will commend the group as a whole to the attention of many who may have avoided it on account of the difficulties which have to be surmounted in making a first acquaintance with the plants composing it.

When the book is critically examined there are not unnaturally points in which one may differ from the authors. The affinity between *Calobryum* and *Monoclea* is really artificial, and they are not generally regarded as closely related. Recent work indicates that the former is more naturally placed near *Haplomitrium*, whilst a considerable difference of opinion exists as regards *Monoclea*, some considering it as near the *Marchantiaceæ*, others as belonging to the *Jungermanniacæ* in the wider sense.

As regards the origin of elaters, probably the *Riccia-Corsinia* series affords a better clue than the more specialised *Anthocerotaceæ*, but it may perhaps

be argued that this is, after all, rather a matter of opinion than of proven conclusion. We feel inclined, however, to take exception to the comparison between the stomata of the grass-like sporophyte of *Anthoceros* and those of the thallus of *Marchantia*, which belongs to the other—the gametophyte—stage in the life-history. The similarity between the two organs is very slight, and although they perform the same function the mode of origin is quite different in the two cases.

But these are small matters in a book which is written for the amateur rather than for the professed botanist, though the latter will also find it worth reading. There are a few misprints which might be corrected—one of them, *Tricholea* for *Trichocolea*, occurs several times—when a new edition is called for. In the meantime, we can congratulate the authors on having written an interesting little book on a difficult series of plants.

REFRACTORY MATERIALS AND PRODUCTS.

Fabrication et Emploi des Matériaux et Produits réfractaires utilisés dans l'Industrie. By Prof. A. Granger. Pp. iv+378. (Paris: Ch. Béranger, 1910.) Price 15 francs.

THE scientific study of firebricks, furnace blocks, crucibles, and other refractory products is one of increasing importance. The progress of metallurgy, of glass-making, of pottery—even the development of the domestic firegrate—demands scientific, as opposed to rule-of-thumb, knowledge of refractory materials and how they may be best applied to the requirements of different industries. Although many excellent refractory products are made in these islands, the scientific study of the subject as a whole has received but little attention as compared with that given to it in Germany, France, and the United States. A few years ago Dr. J. W. Mellor, of the Pottery Laboratory at Stoke-upon-Trent, endeavoured to set up a committee for the study and standardisation of firebrick and refractory materials, and his work is now being carried on, we believe, by a committee of the Iron and Steel Institute, but it appears likely that some considerable time must elapse before we have an English textbook dealing with the subject as fully and as concisely as this French work.

Mr. Granger is well known as the professor of ceramic technology in the school attached to the State porcelain works at Sèvres, and in all his works one recognises the hand of the teacher who finds it necessary to compile a text-book for his students. This is at once the strength and weakness of such a volume. With the usual logical accuracy and perspicacity of a French writer, the author gives an excellent review of his subject. He treats of every variety of refractory material, fireclays, chromite, magnesia, and aluminous products, including the newest materials prepared for electric furnace work.

The book contains a series of excellent illustrations of the various forms of machinery especially adapted for the treatment of fireclays, &c., and the chapter on kilns and methods of firing, which are of extreme

importance in practical work, is excellent. The illustrations of gas-fired kilns, on pp. 81-4, should prove of great value to the English manufacturer, who, so far, has made little use of continental improvements in methods of firing.

The chapter dealing with pyrometry and pyrosopes is also well done, and the discussion of the value of the "Seger" cone is singularly clear and accurate.

We can cordially recommend the work to all who are interested, either as manufacturers or as users of refractory materials, and it would be a still greater pleasure to note the appearance of an English work as comprehensive in scope and plan.

WILLIAM BURTON.

BACTERIOLOGY: GENERAL AND SPECIAL.

- (1) *Agricultural Bacteriology, Theoretical and Practical.* By Prof. John Percival. Pp. x+408. (London: Duckworth and Co., 1910.) Price 7s. 6d. net.
- (2) *A Text-Book of General Bacteriology.* By Prof. W. J. Frost and Prof. E. F. McCampbell. Pp. xvii+340. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 7s. net.
- (3) *Die Eisenbakterien.* By Prof. Hans Molisch. Pp. vi+83. (Jena: Gustav Fischer, 1910.) Price 5 marks.
- (4) *The Sources and Modes of Infection.* By Dr. C. V. Chapin. Pp. ix+399. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1910.) Price 12s. 6d. net.

(1) WE have read this book with much interest. The plan of it is well conceived, and it will serve not only as a useful text-book on agricultural bacteriology, but also as an excellent introduction to general bacteriology for those who are non-medical and do not wish to specialise in the medical and pathological side of bacteriology.

In the opening chapters a general account is given of the bacteria, their physiology, morphology, and classification, and the methods employed in isolating, cultivating, and studying them. Fermentation and enzyme action are then briefly discussed, including putrefaction. Next an excellent account is given of the bacteriology of soil, of nitrification and denitrification, and of the fixation of nitrogen, and, finally, the bacteriology of manure, milk, cream, butter, and cheese is dealt with. Considerable space is rightly devoted to milk and milk products, and the subjects of the sources of bacteria in milk, the fermentations occurring in milk, the filtration, cooling, pasteurisation, and sterilisation of milk, milk and its relation to disease, milk standards, cream and cream ripening, the bacterial content, flavour, and defects of butter, and the ripening of cheese are adequately described. A final chapter is devoted to the yeasts and moulds. Throughout the book series of excellent practical exercises for the student to work out are attached to all the sections. A few errors appear which will need correcting in a future edition. The *B. lactis aerogenes* is described on p. 10 as Gram positive, on p. 275 it is correctly stated to be Gram nega-

tive; on pp. 46-7, dealing with the neutralisation of culture media, it is stated that most bacteria grow best when the medium contains 1 per cent. of free normal acid; this, however, is true only when phenolphthalein is used as an indicator, and such media are alkaline to litmus. On pp. 96-8 the term "proteose" has been substituted several times for "proteolytic enzyme," entirely obscuring the meaning, and on p. 116 "nitrogen peroxide" appears in place of "hydrogen peroxide." The book is clearly printed, and contains a number of appropriate and well-executed illustrations.

(2) The authors state that there is no work in English on the subject of general bacteriology with the exception of the translation of Fischer's "Vorlesungen," and have attempted to supply this want in the present volume. On the whole the matter is presented in a readable and accurate form. The preliminary chapters dealing with the history of bacteriology might have been somewhat extended with advantage, and the omission of any mention of Lister's work on the lactic fermentation seems unpardonable. The chapters summarising the structure and composition of the bacterial cell and the morphology and classification of the bacteria are excellent. The methods employed in bacteriology and the general physiology of the bacteria are detailed at some length, and in the final portion of the book the biology of specialised groups of bacteria are briefly described. We think the authors have succeeded in their endeavour, and have produced a book which will be of considerable service as a general introduction to bacteriology.

(3) This is a monograph on a group of micro-organisms of considerable biological and practical interest. A majority are thread-forming species, and differ essentially in this respect, and also in the fact that they form conidia, from the true bacteria. They live in waters containing iron and have the capacity of "attracting" the iron from its solution and of depositing it around them as ferric hydroxide, which stains them brownish-red in colour. Ultimately the organisms die, sink to the bottom of the water, and cause the reddish-brown colour so often seen at the bottom of streams and ponds. It has been suggested that some of the iron-ore deposits have been formed by the activity of "iron bacteria" living in the warm waters of an ancient sea. They also cause rusting of iron pipes and conduits and masses of their growth sometimes mechanically obstruct the flow of water in pipes. Prof. Molisch has collected in this monograph the descriptions of the known species; and with the attached bibliographies, illustrations, and plates, and details for their investigation, it forms a valuable survey of the group.

(4) Although this subject is dealt with in works on medicine, epidemiology, and bacteriology, and a special work on it might be considered superfluous, a perusal of its contents has convinced us that Dr. Chapin has compiled an extremely useful summary. The life of disease germs outside the body and the conveyance of infection by contact, fomites, air, food and drink, and insects, are fully considered. An im-